STATOR RING VENTILATION ASSEMBLY

DESCRIPTION

This description is applicable to a ventilation assembly for a stator ring designed to transport a gas at a given temperature to a turbomachine stator ring in order to adjust its diameter and the clearance between it and the ends of the rotor blades turning in it.

This type of ventilation assembly is frequently used in turbojets and consists of pipes with several different branches, the ends of which are provided with drillings to blow gas and particularly air at a large number of points judiciously distributed around the ring. Terminal pipes are very frequently manifolds passing around the rings in the form of an arc of a circle and enclosing part of their perimeter. Frequently, the gas is also blown in the axial direction on the outer ribs of the ring rather than on the ring itself such that the diameter is controlled by these ribs that are more rigid and therefore govern the deformations of the ring itself.

The assembly that will be described below is characterized in that it is easy to make, despite the large number of pipes that usually have to be used and it is easy to assemble with the ring despite the complications that may arise due to differential thermal expansion at different times during operation of the machine.

Thus in its most general form, the invention relates to a stator ring ventilation assembly composed of branched pipes comprising feed pipes, distributors

and manifolds adjacent to the ring and provided with drillings through which gas is blown towards the ring, characterized in that the manifolds are composed of pairs of half-shells comprising an end plate and a rim surrounding the end plate, pairs of half-shells being attached by the rims, the distributors comprise coils forming spacers between the manifolds and provided with ends arranged to be adjusted to openings in the side parts of the end plates.

Other characteristics and advantages of the invention will become more obvious after reading the description of the following figures:

- figure 1 is an overview of the assembly,
- figure 2 is a view of a distributor at the branch in a pipe,
- figure 3 shows a method of supporting the assembly on the ring,
- and figure 4 shows a section through a group of manifolds near their end, and a means of support on the ring.

A stator ring 1 is associated with a group of ventilation assemblies 2 conform with the invention, each of which occupies a portion of the circumference of ring 1 and comprises a group of parallel manifolds 3 in the form of an arc of a circle, a distributor 4 that distributes ventilation air between all manifolds 3 and a feed pipe 5 (visible in figure 2) adjacent to distributor 4. In general, the feed pipes 5 join together after one or several other distributors, although these distributors are not shown since they are not the subject of this invention, which is more

specifically related to the end of the ventilation assemblies 2, in other words their parts that are close to the ring 1 to be ventilated. Note also means of supporting manifolds 3 on ring 1, including rules 6, the ends of which are fixed to ring 1 and each of which covers one end of one of the groups of manifolds 3, crossing over them.

As can also be seen on figure 2, each of the manifolds 3 is composed of a left half-shell 7 and a right half-shell 8, each of them being assembled to one of the half-shells. More precisely, the half-shells 7 and 8 of the two types each comprise an end plate 9 that is approximately flat and a rim 10 formed around the end plate 9, the rims 10 of the complementary pairs of half-shells 7 and 8 being along the same line and attached to form a single manifold. The half-shells 7 and 8 may be made by a simple stamping operation and the connections between the rims 10 may be made by welding. This manufacturing method is extremely simple and avoids the need to machine tubes to put them to the required shapes and dimensions, which would probably be much more painstaking. Furthermore, all left half-shells 7 can usually be made using the same tool as the right half-shells 8 that are symmetric to the left half-shells about the joint plane. This overall similarity does not mean that there are not some differences in details. For example, the half-shells 7 and 8 could be made with the different widths of rims 10, for example to give priority to ventilation through the widest manifolds 3. One application example of this process is shown in figure 2, in which three

manifolds 3 ventilate two ribs 11, the central manifold being placed between the two ribs 11 and ventilating both of them, which justifies why its width is doubled. The blower openings 12 through which air escapes from the manifolds 3 are made before or after stamping the half-shells 7 and 8, only leaving out the end half-shells that are not located in front of any of the ribs 11.

Other wider openings marked reference 13 are made through the sides 14 of the end plates 9, apart from one end half-shell 10 to form the distributor 4. The sides 14 extend sideways from the centers of the end plates 9 in this embodiment and are coplanar with them. The ends of manifolds 3 are closed by continuous plates that are welded to them.

The distributor 4 also comprises coils 15 in the form of a short cylinder acting as spacers between the manifolds 3 and with the feed pipe 5. It is often advantageous if they are similar, but they may be different, particularly for the length. They usually comprise rims 16 that engage into openings 13 in the manifolds 3 to hold them in place, and collars 17 bearing on the manifolds 3 to define the separation of the manifolds. The distributor 4 is complete when the coils 15 have been welded to the manifolds 3. However the distribution pipe 5 is usually separate from the distributor 4 and may slide in the input coil 15, with a seal 18 being added between them.

To conclude with figure 2, it will be noted that one of the coils 15 comprises plane and opposite faces 19 enclosing the end 20 (in this case shown enlarged)

of the rib 11, the corresponding coil 15 being on top of the rib 11. The reduction in the axial clearance between the coil 15 and the widened portion of the rib 11 contributes to axial positioning of the distributors 4 on the ring 1. This means that the axial position of distributor 4 is defined, and the air gaps between the manifolds 3 and the control rings 11 can be adjusted more precisely, and convection exchanges by air blown over the rings 11 can be better controlled. Note that the second coil overlaps its ring with an axial clearance, to enable relative expansion between boxes 4 and the casing 1 without causing any hyperstatic connection and unwanted constraints.

The composition of the ventilation assembly made of standard elements welded to each other is particularly easy and advantageous. In the rest of this presentation, we will describe the method in which the ventilation assembly 2 is fixed to ring 1. Figure 3 shows that the end 20 of this rib 11 is provided with a V-notch 21 in which the central cylindrical portion of the coil 15 is supported while self-centering itself, to protect the distributor 4 against radial and tangential movements of ring 1; this enables perfect radial and tangential positioning, and orientation along the engine centerline.

The rules 6 means will now be described fully with reference to figure 4 to show how they provide complementary support for manifolds 3. Brackets 22 are connected to one end of the stator ring 1 through attachment bolts 23 and comprise a flange 24 under one end of the rule 6; the other end of the rule is placed

on a bossing 25 of the stator ring 1. Bolts 26 and 27 are screwed to the flange 24 and to the bossing 25. They hold the ends of the rule 6 in place on the flange and the bossing, compressing springs 28 bearing on the rule 6 through washers 29. This type of assembly gives better control of the thrust of the rules 6 on the brackets 24 and 25. If this force is excessive, the assembly is rigid and does not allow movements due to temperature. The best control is due to the fact that it is easier to calibrate a compression force of a spring 28 by adjusting the height under the collar of dish 31, than to adjust a tension force in a bolt 26 by tightening it to a defined torque. Furthermore, the rule 6 to which the manifolds 3 are welded is formed with wide openings 30 around bolts 26 and 27, so that it can slide axially and tangentially with respect to the stator ring. Therefore this flexible assembly avoids producing excessive internal stresses in the ventilation assembly 2, since the manifolds 3 are able to move above the ring 1 without exerting excessive forces. These relative displacements are usually due to differential thermal expansion. Pressing one of the coils 15 against the end 20 of the corresponding rib 11 also gives some flexibility by allowing the ventilation assembly 2 to move at the ends, while being pulled towards the stator ring 1 and the bottom of the v 21 by the springs 28. This flexibility is valuable since it allows the inevitable differential thermal expansion that occurs with this type of equipment.